EYEGLASS FRAME ASSEMBLY

Related Applications

[0001] This application is a continuation-in-part of United States Patent Application No. 10/610,862, filed on June 30, 2003, which is a continuation-in-part of United States Patent Application No. 10/269,811, filed October 11, 2002 and issued on July 22, 2003 as United States Patent No. 6,595,634, which claims the priority benefit of United States Provisional Application Number 60/394,837, filed July 10, 2002. Each of these applications is incorporated herein by reference in its entirety.

Background of the Invention

Field of the Invention

[0002] The present invention relates to an optometric device. More particularly, the present invention relates to a specially designed eyewear unit or assembly.

Description of the Related Art

[0003] Eyewear styles change frequently and fashionable eyewear can be costly to purchase. In the past, eyewear style has been defined by a frame formed at least partially of metal and/or resin based materials. As such, the eyewear was heavy and the style and size of the lenses were fixed based upon the frame. To accommodate the fashion whims and optical needs of the public, hundreds of eyewear styles with differing lens sizes and shapes must currently be manufactured. To manufacture a frame for each style typically requires a large manufacturing run of each size and shape. This is costly and can result in a cost that is not recovered if the eyewear style is not popular enough to sell sufficient quantities.

[0004] Recently, so-called rimless eyewear has been introduced in which temples and a bridge are directly secured to the lenses with threaded fasteners, posts or the like, which require holes to extend through the lenses. Such rimless eyewear has been quickly adopted within the fashion world. The rimless eyewear is very light due to the lack of a heavy frame around the lenses. However, there are several disadvantages of the truly rimless eyewear. First, the holes used to secure a bridge and a pair of temples to the lenses must be drilled very precisely. Thus, most optical technicians are not able to perform the drilling in-house and outside services must be used. Such outside services are costly and add additional time to the

eyewear supply process such that end users need to wait longer for the eyewear. Further, drilling the necessary holes in the eyewear can lead to lens breakage, even by the outside services. The cost of replacement lenses obviously must be calculated into the end cost of the eyewear, which further increases the cost of eyewear. Finally, the lens materials often may not have the sufficient strength for the long term use and abuse often attributed to some eyeglass wearers. Workers in the eyewear industry, therefore, have been trying to find a better alternative to the truly rimless eyewear currently found in the industry.

Summary of the Invention

[0005] An eyewear assembly is desired in which a single base frame can be used for lenses of varying shapes and sizes. Furthermore, an eyewear assembly is desired in which an optician can easily accommodate the diverse desires of the public for lens shapes and sizes while maintaining a low inventory of frames. Furthermore, a frame assembly is desired that can create a rimless eyewear appearance without the difficulties associated with the supply and assembly of current rimless eyewear.

[0006] According to most embodiments of the present invention, an eyewear system is provided comprising at least one eyewear lens having an end surface that defines a perimeter of the lens. A cable extends around the perimeter with the perimeter having a total length and the cable extending around at least about 90% of the total length.

[0007] According to some embodiments of the present invention, an eyeglass frame assembly is provided comprising a first lens and a second lens. A first cable substantially encircles the first lens and a second cable substantially encircles the second lens. A bridge connects the first cable and the second cable. The first cable has a first end and a second end and the second cable has a first end and a second end. A first closing member is connected to the first cable and the first closing member connects the first end of the first cable to the second end of the first cable. A second closing member is connected to the second cable and the second closing member connects the first end of the second cable to the second end of the second cable.

[0008] According to some embodiments of the present invention, an eyewear system is provided comprising at least one eyewear lens having an end surface that defines a perimeter of the lens. A cable extends around the perimeter. The perimeter has a total length

and less than a total of at least about 10% of the total length of the perimeter is contacted by portions of rigid components.

Brief Description of the Drawings

[0009] These and other features, aspects and advantages of the present invention will now be described with reference to the drawings of several preferred embodiments. The illustrated embodiments are intended to illustrate and not to limit the invention. The drawings comprise 39 figures.

[0010] Figure 1 is a front elevational view of an embodiment of a frame assembly having certain features, aspects and advantages of the present invention.

[0011] Figure 2 is a front elevational view of the embodiment of Figure 1 with the lenses installed.

[0012] Figure 3 is an enlarged perspective view of a portion of a wire that can be used in the embodiment of Figure 1.

[0013] Figure 4 is a sectioned view of a locking unit of the embodiment of Figure 1.

[0014] Figure 5 is a sectioned view of a hook unit used with the embodiment of Figure 1 to create a clip-on auxiliary frame assembly.

[0015] Figure 6 is a side elevational view of the embodiment of Figure 1 with hook units installed to create a clip-on auxiliary frame assembly.

[0016] Figure 7 is a sectioned view of another hook unit used with the embodiment of Figure 1 to create a clip-on auxiliary frame assembly.

[0017] Figure 8 is a partial perspective view of another embodiment of a frame assembly having certain features, aspects and advantages of the present invention.

[0018] Figure 9 is an enlarged sectioned view of the frame assembly of Figure 8 taken along line 9-9 of Figure 8.

[0019] Figure 10 is an enlarged sectioned view of the frame assembly of Figure 8.

[0020] Figure 11 is a partial perspective view of the frame assembly of Figure 8 with the lens secured.

[0021] Figure 12 is a sectioned view of the frame assembly of Figure 8 taken along line 12-12 of Figure 11.

[0022] Figure 13 is a sectioned view of the frame assembly of Figure 8 taken along line 13-13 of Figure 12.

[0023] Figure 14 is a sectioned view of the frame assembly of Figure 8 taken along line 14-14 of Figure 11.

[0024] Figure 15 is a perspective view of another embodiment of a frame assembly having certain features, aspects and advantages of the present invention.

[0025] Figure 16 is a sectioned view of the frame assembly of Figure 15 taken along line 16-16 of Figure 15.

[0026] Figure 17 is a sectioned view of the frame assembly of Figure 15 taken along line 17-17 of Figure 15.

[0027] Figure 18 is a perspective view of another embodiment of a frame assembly having certain features, aspects and advantages of the present invention.

[0028] Figure 19 is a top plan view of the frame assembly of Figure 18.

[0029] Figure 20 is a sectioned view of the frame assembly of Figure 18 taken along line 20-20 of Figure 18.

[0030] Figure 21 is an exploded perspective view of a portion of the frame assembly of Figure 18.

[0031] Figure 22 is an exploded perspective view of a portion of another embodiment of a frame assembly having certain features, aspects and advantages of the present invention.

[0032] Figure 23 is a partial exploded perspective view of another embodiment of a frame assembly having certain features, aspects and advantages of the present invention.

[0033] Figure 24 is a sectioned view of the frame assembly of Figure 23 illustrating the connection of a nose piece to a lens.

[0034] Figure 25 is a developed view of the nose piece of Figure 24 showing the nose piece prior to bending.

[0035] Figure 26 is a perspective view of a further embodiment of a frame assembly having certain features, aspects and advantages of the present invention.

[0036] Figure 27 is a sectioned view of the embodiment of Figure 26 taken along line 27-27 of Figure 26.

[0037] Figure 28 is a sectioned view another frame assembly having certain features, aspects and advantages of the present invention.

[0038] Figure 29 is a perspective view of a primary eyewear frame with attached temples and a corresponding auxiliary eyewear frame without attached temples in which both frame assemblies are arranged and configured in accordance with certain features, aspects and advantages of the present invention.

[0039] Figure 30 is a sectioned view taken along line 30-30 of Figure 29 showing a flexible cable disposed within a groove of a lens.

[0040] Figure 31 is an exploded view of an embodiment of a frame assembly having certain features, aspects and advantages of the present invention and incorporating a lens holding structure closing mechanism that contains a magnetic member.

[0041] Figure 32 is an exploded view of an embodiment of a frame assembly having certain features, aspects and advantages of the present invention and incorporating another lens holding structure closing mechanism that contains a magnetic member.

[0042] Figure 33 is a sectioned view of another embodiment of a frame assembly having certain features, aspects and advantages of the present invention and incorporating a lens holding structure closing mechanism that contains a magnetic member.

[0043] Figure 34 is a sectioned view of the embodiment of Figure 33 taken along the line 34-34 in Figure 33.

[0044] Figure 35 is a perspective view of a lower closing member of the embodiment of Figure 32.

[0045] Figure 36 is a perspective view of a wire with a balled end that can be used with certain embodiments that are arranged and configured in accordance with certain features, aspects and advantages of the present invention.

[0046] Figure 37 is a perspective view of an embodiment of a frame assembly having certain features, aspects and advantages of the present invention and incorporating a lower closing member of a mechanism using the wire of Figure 36.

[0047] Figure 38 is a perspective view of an embodiment of a frame assembly having certain features, aspects and advantages of the present invention and incorporating a lens holding structure closing mechanism featuring the lower closing member of Figure 37.

[0048] Figure 39 is a partial perspective view of a further embodiment of a frame assembly having certain features, aspects and advantages of the present invention and incorporating magnetic members having a substantially vertical orientation.

Detailed Description of the Preferred Embodiment

[0049] The present invention relates to eyewear frame assemblies. In at least one embodiment of the present invention, the eyewear frame assembly features a cable that forms at least a major portion of a lens circumscribing frame. The cable can extend around a lens and is tightened about the lens to allow the end product to have a customizable shape and configuration while providing a generic eyewear frame assembly that is capable of customization. Preferably, the cable extends around about 90% of the circumference of the associated lens. In some embodiments, the cable extends around about 95% of the circumference of the associated lens. In other embodiments, the cable extends entirely around the circumference of the associated lens. By extending the cable around substantially the entire circumference of the associated lens, a rimless look is provided to eyewear while creating a flexible and durable lens mounting arrangement as compared to other rimless or semi-rimless eyewear (e.g., eyewear with the lens secured in a metal frame with a nylon cord). In addition, such a construction eases assembly by opticians and the like. Furthermore, in some embodiments, rigid components, such as, for example but without limitation, a bridge, a brow bar, or closing members are positioned along the circumference of the associated lens. Preferably, these rigid components together span less than about 10% of the total circumferential length of the lens. In some embodiments, the rigid components span less than about 5% of the total circumferential length.

[0050] With reference initially to Figure 1, a frame assembly 11 used in making a customizable eyewear assembly having certain features, aspects and advantages of one embodiment of the present invention is shown. The frame assembly 11 generally comprises a tension bar 13 and a pair of flexible wire members 15 or cables.

[0051] The tension bar 13 of the illustrated embodiment provides a support for the flexible wire members 15 and the lenses 19 (see Figure 4). The illustrated tension bar 13 supports a locking unit 17 at each end. The tension bar 13 can be made of any suitable material but preferably is made from a metal, metal alloy or metal composite composition.

The illustrated wires 15 can be connected to either end of tension bar 13. In some embodiments, the wires are connected to an exterior of the locking unit and, in other embodiments, both ends are positioned within the locking units (see Figure 4).

[0052] In the illustrated embodiment, each of the wires 15 preferably is made from a metal, metal alloy or metal composite. The wires 15 desirably are pliable and easily wrap around the respective lenses 19, which can comprise a tinted lens, a corrective lens or any other desired type of lens, including a protective lens. The wires 15 advantageously allows the frame assembly to captures lenses of substantially any size or configuration such that another pair of eyewear can be mimicked or copied. In the illustrated arrangement, each wire 15 has a free end 16 that, during assembly, can be fed through the corresponding screw locking unit 17.

[0053] Each wire 15 may be a multi-filament cord or a monofilament strand, as described in detail hereinafter. The wire 15 in the illustrated arrangement is a substantially flattened member as shown in the enlarged view of Figure 3. The illustrated wire 15 comprises a longitudinally extending central portion 10 and a pair of longitudinally extending sidewalls 12. Together, the sidewalls desirably are sized and spaced for wrapping about and otherwise grabbing an edge of the respective lens 19 (see Figure 4). Thus, the wire 15 illustrated in Figure 3 comprises lateral surfaces that grab respective edges of the associated lens. The central portion 10 preferably is formed with a plurality of running grooves 23. Other suitable arrangements can comprise a wire with embossed ridges or the like.

[0054] In the illustrated arrangement, each wire 15 has a free end 16 that, during assembly, can be fed through the corresponding screw locking unit 17. With reference now to Figures 1, 4 and 6, the illustrated locking units 17 generally are defined by a tubular-shaped housing 30. While the illustrated arrangement features a tubular-shaped housing 30, other shapes also can be used such as rectangular, elliptical or the like. The housing 30 preferably is made of stainless steel, carbide, titanium, or the like. While metal is preferred, other high strength materials also can be used.

[0055] The housing 30 in the illustrated arrangement generally encapsulates a screw member 33. The screw member 33 comprises a body 34 formed with a head 35 at one end and a plurality of outer annular threads 39 extending along at least a portion of the length

of the body 34. The body 34 can be formed of any suitable material, including, but not limited to, metal. The head 35 can be formed with a driver-engaging configuration 37, such as a single slot, a pair of crossing slots, a raised ridge or the like. The driver-engaging configuration 37 allows for a positive lock between a tool and the screw member 35. The driver-engaging configuration 37 preferably is sized for receiving the end of a conventional screwdriver, or the like, such that the screw member 33 can be rotated for reasons that will be discussed.

[0056] The illustrated housing 30 of the locking unit 17 is formed with a passage 40 running therethrough. The passage 40 advantageously is sized for selectively receiving the free end 16 of the wire 15. The passage 40, therefore, can have a similar cross-sectional configuration to the cross-sectional configuration of the wire 15. The illustrated housing 30 also comprises a stop 41, which substantially restrains the screw unit 33 from translation relative to the housing 30. The stop 41 can be integrally formed within the housing or can be a separate component that is suitably secured to the housing 30.

[0057] The illustrated frame assembly 11 preferably comprises clip assemblies 21 that can be used to secure clip-on sunglasses to a pair of conventional eyeglasses during use. An embodiment of clip assemblies 21 arranged and configured in accordance with certain features, aspects and advantages of the present invention are illustrated in Figures 5-7. In the embodiment of Figure 5, the clip assembly 21 includes a first hook element generally indicated at 22 and a second hook element generally indicated at 24. In the illustrated arrangement of Figure 5, the first hook element 22 and the second hook element 24 are integrally formed. It is contemplated, however, that the two hook elements can be separately formed and joined together in any suitable manner (e.g., welding, brazing, adhering, positive mechanical interlock, etc.).

[0058] As illustrated on the right side of Figure 5, the first hook element 22 advantageously comprises a slot 27 through which the wire 15 runs. Similar to the passage 41, the slot 27 desirably is sized and configured to have a cross-sectional configuration that matches that of the wires 15. The first hook element preferably is sized and positioned to extend alongside the lens 19. The second hook element 24 of the hook assembly 21 comprises a cushion 25. The cushion 25 preferably extends around the second

hook element 24. With reference to Figure 5, the illustrated cushion 25 advantageously provides a suitable location for connection to an eyeglass frame 29. As can be appreciated from viewing Figure 5, the hook assembly 21 enables the clip assembly to be aligned with the eyeglass frame of the prescription eyeglasses during use.

[0059] In use, a pair of lenses 19 is prepared as desired. In one embodiment, the lenses 19 are identical in size, shape and design to the lenses of a wearer's regular eyeglasses. Each wire 15 is fed through the slot 27 of the hook assembly 21 and the wire is wrapped around respective lens 19. The free ends 16 of each wire 15 are fed into the passage 40 of the corresponding locking unit 17 as shown in Figure 4. Turning the screw member 33 causes the threads 39 to engage or grab the grooves 23 at the end 16 of wire 15, which draws the wire 15 into the locking unit 17. As a result, a custom eyeglass assembly 11 can be formed with a frame suited to almost any lens shape or size. As will be described later, a frame featuring the locking unit 17 also may be used in the assembly of an eyeglass frame itself in which the lens openings are defined by a flexible wire such as multi-filament cable.

[0060] With reference to Figures 6 and 7, another embodiment of the hook assembly 21' is illustrated. The hook assembly 21' comprises a first hook element 22' and a second hook element 24'. In this embodiment, the hook element 22' is formed integrally with the wire 15, or formed separately and secured thereto, as illustrated in Figure 6. The hook element 24' of the embodiment shown in Figure 6 preferably is substantially identical to hook element 24 depicted in Figure 5 and has a cushion 25' disposed thereabout.

[0061] With respect to the embodiments of Figures 1-7, most often during assembly, there will be excess wire. Typically, the excess wire is first cut to a length that is sufficient for wrapping around the sunglass lens and locking at its end within its respective locking unit. The excess wire can also be trimmed following assembly to provide a clean appearance to the eyewear assembly.

[0062] With reference now to Figures 8 and 9, a further embodiment of an eyewear frame assembly 111 is shown. The frame assembly 111 comprises a tension bar 113 and a pair of wires 115. The wires 115 preferably are substantially flexible and extend from either end of the tension bar 113. The wires 115, however, can be connected to the tension bar by an intervening structure, such as a locking unit 117. In the illustrated arrangement,

one end of the wire 115 is secured to an exterior surface of the locking unit 117. In other arrangements, the wire 115 can be secured to an interior surface of the locking unit 117 at both ends. The material of the tension bar 113 preferably comprises a metal, metal alloy or metal composite composition. The tension bar 113 also can be formed from other suitable materials, such as resin-based materials or the like.

[0063] Each wire 115 desirably has a multi-filament structure, such as a multi-filament cable wire. In some embodiments, the filaments that define the wire 115 are made from a metal, a metal alloy, a nylon, a polymer, a resin, a natural fiber or a naturally occurring or man-made material that is suitably strong in tension and flexible. The wire 115 also can have a monofilament structure using any of the above-mentioned materials. In some embodiments, the wire 115 may be manufactured of a fiber-optic material. In one embodiment, the multi-filament material is a multi-filament cable wire comprising a plurality of individual filaments 118 (see Figure 14) that are retained within a casing 120. In one embodiment, the wire 115 is constructed similarly to a braided fishing leader wire. Such a wire is extremely flexible and strong so that it can easily wrap around a sunglass lens in a secure fashion, as described below. In some embodiments, the wire has a thickness of between about 0.1 mm to about 3.0 mm. Preferably, the multi-filament cable wire has a thickness of between about 0.4 mm and about 1.6 mm, and more preferably has a thickness of between about 0.4 mm and about 0.6 mm. In one embodiment, the wire has a thickness of about 0.5 mm.

[0064] Each wire 115 has a free end 116 that can be fed through the corresponding locking unit 117. In the illustrated embodiment, as shown in Figure 9, one locking unit 117 is located at and attached to the each end of the tension bar 113. In accordance with this embodiment, the outer edge 121 of the lens 19 advantageously is formed with a groove 122 (see Figures 13 and 14) within which at least a portion of the circumference of the wire 115 is received. The wire 115 preferably is sized for wrapping about and securing an outer edge 121 of a lens 119 (see Figure 10). Thus, the wire 115 has a length sufficient to extend around the perimeter of the lens 119 and a diameter small enough to fit within the groove 122.

[0065] With reference now to Figures 9 and 10, one of the locking units 117 is fixed at each of the ends of the illustrated tension bar 113. Each locking unit preferably is defined by a housing 130. In the illustrated embodiment, the housing 130 comprises a main body and a roof 138. Preferably, the housing 130 is made of stainless steel, carbide, titanium or some other high performance metal. In some embodiments, the housing 130 can be formed of other suitable materials, including, but not limited to, carbon fiber materials or plastics. The illustrated housing 130 is formed with an opening 132 leading into a passage 140. The passage 140 extends through the main body of the housing 130. The passage 140 advantageously is sized for receiving a free end 116 of the wire 115. The passage 140 also comprises another opening 134. Adjacent the opening 134 in the illustrated embodiment is an upper slot 136. The illustrated upper slot 136 is located at the rear end of roof 138. A pivotally flexible membrane 142 depends from roof 138 adjacent opening 132 of housing 130 and is at least partially disposed within the passage 140.

[0066] With continued reference to Figure 8 and additional reference to Figure 10, a set screw 144 is adapted to engage with the housing 130. The screw 144 in the illustrated embodiment engages with a screw opening 146 defined at the end of the housing 130. The screw opening 146 extends into the passage 140 such that the screw 144, when placed in the opening 146, extends into the passage 140 through a portion of the passage 140 that is intersected by an imaginary extension of said slot 136. The screw 144 has a tip or an end that pinches against the respective wire 115 such that the wire 115 can be secured in position within the housing 130. Furthermore, in the illustrated embodiment, the screw 144 pinches the wire 115 or cable against the membrane 142. Preferably, the membrane 142 or tab is positioned about one diameter of the cable from the end of the screw 144 such that the wire 115 or cable can be secured between the membrane and the screw 144. The flexible membrane 142 desirably flexes or pivots upward due to the forces imposed by the wire 115 and the screw 144, which movement further secures the end 116 of the wire 115 in position within the housing 130.

[0067] Eyewear, either primary or an auxiliary clip-on, can be formed with the arrangement of Figures 8-14. As shown, a pair of lenses 119 to be mounted can be prepared. Preferably, each of the lenses includes a groove 122, channel or the like that extends about a

periphery of the lens 119. If used in the preparation of an auxiliary clip-on, the lenses 119 can be similar in size, shape and design to the lenses and/or frame of a wearer's regular or primary eyeglasses. The wire 115 can be wrapped about each lens 119 respectively, preferably within the groove 122. The free end 116 of the wire is fed through the opening 132 and into the passage 140 of the corresponding locking unit 117. The end of the wire is also fed through the opening 134 and bent upward through the slot 136, as shown in Figure 10. The screw 144 is inserted and tightened in the passage 140 of the housing 130. Excess wire can be removed once the end 116 of the wire 115 is secured in position. Desirably, the end of the wire 115 is disposed within the slot 136 and, in one preferred arrangement, the end of the wire 115 is positioned flush along the roof 138 (see Figure 12).

[0068] With reference now to Figures 15, 16 and 17, a frame 211 that is arranged and configured in accordance with certain features, aspects and advantages of an embodiment of the present invention is illustrated. The illustrated frame 211 comprises a pair of earpieces or temples 215, a bridge or nosepiece 217 and lens holding structures 219. The lens holding structures 219 are sized and configured to receive a pair of lenses 221.

[0069] The two ends of each of the lens holding structures 219 are selectively secured together. In the illustrated arrangement, the two ends are disposed proximate the temples 215. As such, a pair of closing members 223 is provided with one closing member 223 being associated with each of the ends. With continued reference to Figure 17, the ends of the cable preferably are fixed to the closing members 223 such as by welding, soldering or any other suitable method. In some embodiments, an anchoring arrangement, which is discussed below, can be used for both connections.

[0070] The closing members 223 preferably comprise two openings 225 through which screws 227 may be threaded. For instance, the openings 225 in one closing member 223 may be threaded while the holes 225 in the other closing member 223 are not threaded such that the two closing members 223 can be drawn together when the screws 227 are tightened into the openings 225. In such a construction, many different lens sizes and shapes can be accommodate so long as the perimeter dimension (e.g., circumferential length) is the same. While this construction ultimately limits the number of size/shape combinations

that can be accommodated, this construction is advantageous to use in high volume production applications.

[0071] Each of the illustrated earpieces or temples 215 preferably is pivotally received between the closing members 223 at either end of frame assembly 213. In other words, each of temples 215 preferably includes an opening 229 which can be aligned with one set of the openings 225 of the closing members 223. In the illustrated arrangement, the opening 229 is aligned with the outer set of openings 225 of the closing members 223. The screw 227 extends through all three openings so that temple 215 can be secured between the closing members, as shown in Figure 15. In other arrangements, the temple 215 can underlay or overlay the coupled closing members 223, if so desired. Other suitable manners also can be used to attach the temple and/or to form a temple hinge.

[0072] The illustrated lens holding structures 219 preferably are formed by a cable 222. The cable 222 can comprise a multi-filament construction or a monofilament construction. The cable 222 in one embodiment is formed of a flexible material, such as, but not limited to, a metal or metal alloy, a nylon, a polymer, a resin, a natural fiber, or any other naturally occurring or man-made material. In one embodiment, the cable 222 is formed of multiple filaments 233 (see Figure 16) that are retained in a casing 235. Advantageously, the cable is flexible and strong so that it can be easily wrapped around the lens 221 in a secure fashion.

[0073] The cable also accommodates a wide variety of lens sizes and shapes because its length can be readily adjusted by, for example but without limitation, cutting away excess cable. When the frame 211 is designed with different shaped or sized lenses, the cable 222 can be easily replaced and the new cable 222 can be wrapped securely around the new lenses. Preferably, the multi filament cable 222 has a thickness of between about 0.1 mm and about 3.0 mm, and more preferably has a diameter of between about 0.1 mm and about 0.6 mm. The multi-filament cable used in this aspect of the invention has superior flexibility and strength as compared to conventional wires.

[0074] With reference now to Figures 16 and 17, each of the lenses 221 preferably has an outer edge formed with a groove 231 in which the cable 222 is received. Preferably, the groove 231 is sized relative to the cable 222 such that the cable is substantially hidden

from view. In one particularly preferred arrangement, the depth of the groove 231 is greater than the width of the groove 231 and the depth of the groove 231 is about the same as the diameter of the cable 222.

[0075] The frame 211 advantageously is simple for an optician/technician to assemble due to the simple locking mechanism. The frame 211 also provides an appearance of a rimless frame assembly while not requiring drilling into the lens of the eyewear. Furthermore, while multi-filament cable is believed to be stronger than a simple mono-filament cable or wire, both cable constructions, when used with the disclosed constructions, facilitate the capture of lenses having varying sizes and configurations within a single base frame construction. Furthermore, the use of a cable in tension results in a frame that is much lighter than a convention frame while also providing superior frame flexibility.

[0076] With reference now to Figures 18-21, another embodiment of a frame 311 that is arranged and configured in accordance with certain features, aspects and advantages of the present invention is illustrated. The frame 311 comprises a pair of ear pieces or temples 315, a bridge or nose piece 317, and lens holding structures 319 that receive a pair of lenses 321. Extending from each lens holding structure 319 is a pair of closing members 323A, 323B, each having a corresponding pair of openings 325A and 325B through which screws 327 can be threaded. Each ear piece or temple 315 can be received between the corresponding pair of closing members 323A and 323B in a manner similar to the embodiment depicted in Figures 15-17.

[0077] In the illustrated embodiment, each lens holding structure 319 comprises a cable 322 having ends 324A and 3248. In one embodiment, the cable 322 has a multi-filament construction. In another embodiment, the cable 322 has a mono-filament construction. Preferably the cable 322 is formed in any of the manners described above.

[0078] With reference to Figures 19 and 20, the lens 321 is received within the lens holding structure 319, which is preferably defined by the cable 322. In the illustrated embodiment, the lens 321 has an outer edge formed with a groove 331 (see Figure 21) in which the cable 322 is received. As discussed above, the groove 331 preferably is sized relative to the cable 322 such that the cable 322 is substantially hidden from view. In one embodiment, the depth of the groove 331 is greater than the diameter of the cable 322.

[0079] In the illustrated arrangement, the ends 324A, 3248 of the cable 322 advantageously are coupled to the members 323A and 323B by a "ball and chain" locking design. The locking design is illustrated, for example, in Figures 20 and 22. With reference to Figures 20 and 21, the upper closing member 323A preferably is formed with a recess 341 that is accessible from an underside of the closing member 323A via an opening 345. In the illustrated embodiment, the recess 341 is rectangular in shape. Other shapes also can be used. Extending from the recess 341 to the top side of the closing member 323A is an opening 347 sized for receiving an end 324A of the cable 322. In one embodiment, the opening is generally cylindrical in shape and in another embodiment the opening extends angularly upward and is generally cylindrical in shape.

[0080] With continued reference to Figures 20 and 21, the end 324A of the cable 322 is coupled to an anchor 343 (See Figures 20-21). In the illustrated arrangement, the anchor 343 is rectangular in shape. Other shapes also can be used, such as, for example but without limitation, conical, spherical, oval, etc. The cable 322 can be fed through the opening 347 and the anchor 343 can be seated in the recess 341. This configuration allows the cable 322 to be secured to the closing member 323A.

[0081] The other closing member 323B preferably is formed with another opening 349. In the illustrated arrangement, the opening 349 undulates and, in one preferred embodiment, the opening 349 breaks through the upper and lower surfaces of the closing member 323B. The opening 349 preferably allows the two closing members 323A, 323B to squeeze the cable 322 between the closing members 323A, 323B such that the cable 322 is secured in position. As with the embodiments set forth above, excess cable 322 can be cut or otherwise removed such that the cable 322 fits snuggly around lens 321.

[0082] With reference to Figure 21, the closing members 323A, 323B preferably are formed with nipple elements 351, 353. The illustrated nipple elements 351, 353 can be vertically aligned with one another and are sized and configured to be received within the groove 331 formed along the outer edge of the lens 321. As illustrated, the nipple elements preferably extend in the portion of the groove defined between the ends 324A, 324B of the cable 322. Thus, the nipple elements 351, 353 facilitate engagement between the closing members 323A, 323B and the respective lens 321.

[0083] With reference now to Figure 22, another version of the "ball and chain" locking design is shown in which the upper closing member 323A is formed with a generally spherically shaped recess 365 for receiving an anchoring ball member 363 fixedly attached to the end 324A of the cable 322. As mentioned above, in other embodiments, the recess 365 can have any three-dimensional configuration for receiving a corresponding member 363 of a complementary configuration. Alternatively, instead of the end 324A of the cable 322 being fixed to an anchoring member, the end 324A simply can be tied in a knot form in order to lock the end 324A in the recess 365 formed in the closing member 323A. Advantageously, however, the anchor member is juxtaposed over the opening in the lower closing member 323B such that the anchor member, which can extend slightly downward relative to the bottom surface of the upper closing member 323A, can clamp the cable 322 in position within the lower closing member 323B.

[0084] With reference now to Figures 23-25, a further frame 411 that is arranged and configured in accordance with certain features, aspects and advantages of the present invention is illustrated. The frame 411 comprises a pair of ear pieces or temples (not shown), a bridge or nose piece 417, and lens holding members that receive a pair of lenses 421 (one of which is shown). Each lens holding member comprises a cable 422. The cable can be configured in any of the manners and of any of the materials set forth above. It is preferred, however, that the cable 422 be of the multi-filament construction. As with the embodiments set forth above, the lens 421 preferably is secured by the cable 422 and the lens preferably has an outer edge formed with a groove 431 in which the cable 422 is received. The cooperation of the cable 422 and the groove 431 preferably results in a rimless appearance for the eyewear. Accordingly, the two can be sized and shaped as set forth above.

[0085] With reference to Figures 23-25, the illustrated bridge/nose piece 417 advantageously includes a flexible projection 419 that extends downwardly at either end. The projections 419 are connected by a central portion 420. The central portion 420 preferably has a tubular cross-section. The tubular cross-section can be cylindrical, square or any other suitable shape. A rounded contour is preferred for comfort; however, square or other cross-sectional shapes can be used for differing fashion looks. In some embodiments, the central portion 420 can be solid; however, the tubular construction is advantageously

strong and yet light weight. The projection 419 can abut against the outer edge of the corresponding lens 421. Each projection 419 can be formed with a generally vertically extending guide 427. The guide 427 can be wire-shaped or can be shaped like the nipple elements 351, 353, which were described above. The guide 427 preferably is sized for placement within the groove 431 of the lens 421. Advantageously, a pair of holes 425 can be located at either end of the guide 427 such that the cable 422 can pass through the holes and secure the projection to the side of the lens 421.

[0086] With reference to Figures 26-27, a nose piece or bridge 447 can be formed with a channel or slot 441 through which the cable 422 can extend. In this manner, the bridge 447 can be secured to the lens in a manner similar to the projections 419 described above. In another embodiment, such as that shown in Figure 28, the cable 422 can be split and secured to the top and the bottom of the bridge 447. In one embodiment, the cable 422 is soldered to the bridge 447. Other suitable securing techniques, including the ball and chain type, can also be used. While the bridge is shown being attached in the embodiments of Figures 25-27, the temples also can be attached in similar manners and the bridge also can be connected in any of the manners described above.

[0087] With reference now to Figures 29-39, several embodiments of eyewear assemblies are illustrated therein. The illustrated eyewear assemblies generally relate to primary frame assemblies and auxiliary frame assemblies that are magnetically securable to the primary frame assemblies. As used herein, a magnetic coupling can comprise a pair of magnets or a single magnet and a material that is attracted to the magnet through magnetic forces.

[0088] With reference initially to Figure 29, a primary frame 500 and a secondary or auxiliary frame 502 as shown. The primary frame 500 and the secondary frame 502 preferably feature a pseudo wireless rim configuration, such as those discussed above. In other words, the primary frame 500 comprises a cable 504 that is disposed within a groove 508 that is formed in an outer periphery of a lens 506. As illustrated in Figure 30, the cable 504 preferably is sized to be recessed entirely or almost entirely within the groove 508. As such, the cable 504 advantageously is substantially concealed from view and the lenses appear to be mounted in a rimless manner. The cable 504 can be connected to the balance of

the frame components (e.g., temples, bridge, etc.) in any suitable manner, such as those set forth above. The secondary frame can be configured in the same manners.

[0089] With reference now to Figure 31, a primary frame 600 is illustrated in an exploded manner. A lens 602 can be mounted in a suitable manner to within a cable 604 that forms a lens supporting structure. In the illustrated arrangement, the lens 602 comprises a groove 606 that extends around a periphery of the lens 602. As discussed above, the groove preferably allows the cable 604 to be substantially hidden from view. In some embodiments, the cable 604 may be only partially recessed such that the cable 604 forms a decorative element of the eyewear. Presently, however, the rimless appearance of the eyewear is desired and, thus, the cable 604 desirably is recessed from view. Futhermore, the cable 604 can be of the multi-filament or mono-filament construction and can be formed from any of the materials discussed above.

[0090] With continued reference to Figure 31, two portions of the cable 604 that encircles each lens 602 are connectable using a pair of closing members 610, 612. The upper closing member 610 comprises a pair of holes 614, 616 and the lower closing member also comprises a pair of holes 618, 620. The hole 614 and the hole 618 preferably are aligned while the hole 616 and the hole 620 preferably are aligned. The holes 614, 616, 618, 620 accommodate threaded fasteners 622. In the illustrated arrangement, the fasteners (e.g., screws) 622 cooperate with nuts 624 to allow the two members 610, 612 to be tightened together. In some embodiments, the nuts 624 can be obviated by tapping one of the holes of each respective pair of holes.

[0091] In the illustrated arrangement, the closing members 610, 612 accommodate a portion of a temple member 626. The temple member can include a hole 630 that aligns with one of the pair of holes, such as the holes 616, 620. In this manner, the temple can be pivotally attached to the members 610, 612. Other suitable manners of connecting the temple 626 to the cable 604 also can be used.

[0092] With continued reference to Figure 31, a magnetic member 632 is disposed within a recessed chamber in the closing members 610, 612. The magnetic members can have any suitable size or shape. The magnetic member 632 can be embedded in at least one of the closing members 610, 612, secured by adhesives or the like to at least

one of the closing members 610, 612 or secured in a secondary housing or sleeve that is, in turn, secured to at least one of the closing members 610, 612. Other suitable manners of connecting the magnetic member to the frame 600 also can be used. The magnetic members can attach to another magnetic member through direct contact or with an intervening surface. As such, magnetically connected means that the magnetic members allow two components to be connected by magnetic force regardless of whether the magnetic members actually make physical contact. In addition, the magnetic members can be recessed, mounted flush or protrude from the surface to which or in which they are mounted.

[0093] In one embodiment, the closing members 610, 612 can be formed of a magnetizable member (e.g,. a ferrous metal such as iron or steel) such that the closing members themselves become magnetized. In such an embodiment, a fully concealed magnet could be used. In the illustrated embodiment, the recess extends through a forward facing surface of the at least one of the closing members 610, 612 thereby forming a window or the like. The window 634 can be used to allow the magnetic field to be exposed in a desired direction (e.g., forward in the illustrated arrangement). The use of "window," however, does not necessarily mean that the magnet is visually exposed but, rather, means that the effects of the magnetic member (e.g., magnetic field) can be detected at this location. The window can simply be an opening through which the magnetic member is embedded into the closing member.

[0094] With reference now to Figure 32, a secondary frame 700 is illustrated. The secondary frame 700 can be configured in a similar manner to the primary frame 600 described above. A lens 702 can be mounted in a suitable manner to within a cable 704 that forms a lens supporting structure. In the illustrated arrangement, the lens 702 comprises a groove 706 that extends around a periphery of the lens 702. As discussed above, the groove 706 preferably allows the cable 704 to be substantially hidden from view. In some embodiments, the cable 704 may be only partially recessed such that the cable 704 forms a decorative element of the eyewear. Presently, however, the rimless appearance of the eyewear is desired and, thus, the cable 704 desirably is recessed from view. Futhermore, the cable 704 can be of the multi-filament or mono-filament construction and can be formed from any of the materials discussed above.

[0095] With continued reference to Figure 32, two portions of the cable 704 that encircles each lens 702 are connectable using a pair of closing members 710, 712. The upper closing member 710 comprises a pair of holes 714, 716 and the lower closing member 712 also comprises a pair of holes 718, 720. The hole 714 and the hole 718 preferably are aligned while the hole 716 and the hole 720 preferably are aligned. The holes 714, 716, 718, 720 accommodate threaded fasteners 722. In the illustrated arrangement, the fasteners (e.g., screws) 722 cooperate with nuts 724 to allow the two closing members 710, 712 to be tightened together. In some embodiments, tapping one of the holes of each respective pair of holes can obviate the nuts 724.

[0096] With continued reference to Figure 32, a magnetic member 732 is disposed within a recessed chamber in the closing members 710, 712. The magnetic member 732 can be embedded in at least one of the closing members 710, 712, secured by adhesives or the like to at least one of the closing members 710, 712 or secured in a secondary housing or sleeve that is, in turn, secured to at least one of the closing members 710, 712. Other suitable manners of connecting the magnetic member to the frame 700 also can be used. In one embodiment, the closing members 710, 712 can be formed of a magnetizable member (e.g., a ferrous metal such as iron or steel) such that the closing members themselves become magnetized. In such an embodiment, a fully concealed magnet could be used. In the illustrated embodiment, the recess extends through a forward facing surface of the at least one of the closing members 710, 712 thereby forming a window or the like. The window 734 can be used to allow the magnetic field to be exposed in a desired direction (e.g., forward in the illustrated arrangement).

[0097] With reference now to Figures 33-35, a portion of another embodiment of eyewear 800 arranged and configured in accordance with certain features, aspects and advantages of the present invention is illustrated therein. The eyewear 800 features another closing arrangement 802. The closing arrangement 802, similar to some of the arrangements set forth above, allows for the usage of a single stock frame assembly that can accommodate lenses of various sizes and shapes. The illustrated closing arrangement 802 also provides the added capability of use in a magnetically securable manner. For instance, if the arrangement

is used for a primary frame, a magnetically securable secondary frame can be used and vice versa.

[0098] In the illustrated arrangement, a lens 804 features a peripheral groove 806. The groove 806 is sized and shaped to accommodate a cable 808, as described above. The groove 806 and the cable 808 can have any suitable configuration, including those set forth above. The cable 808 has one end 810 that is secured to one of a pair of closing members 812, 814. In the illustrated arrangement, the end 810 of the cable 808 is soldered, welded, mechanically locked, or the like to the lower closing member 814. The other of the closing members 812, 814, which is the upper closing member 812 in the illustrated arrangement, comprises a through passage 820.

[0099] The illustrated through passage 820 is aligned with a sharply turned passage 822 that is formed along an upper surface 824 of the lower closing member 814. The upper surface 824 of the illustrated lower closing member 814 abuts a lower surface 826 of the upper closing member 812 such that the cable 808, when positioned within the passage 822 can be secured in position by compressive forces that result when the two closing members 812, 814 are tightened together. For this reason, the passage 822 preferably is slightly shallower than the diameter of the cable 808 and the closing members 812, 814 are secured together in a manner that allows them to be drawn together (e.g., with threaded fasteners 830).

[0100] As discussed above, at least one of the closing members 812, 814 preferably contains or is formed of a magnetic member 832. The magnetic member 832 can be positioned proximate a window 834 or the like. Furthermore, the magnetic member 832 can be mounted in any manner set forth herein. In one embodiment, the magnetic member 832 is disposed within a recessed chamber in the closing members 812, 814. The magnetic member 832 can be embedded in at least one of the closing members 812, 814, secured by adhesives or the like to at least one of the closing members 812, 814 or secured in a secondary housing or sleeve that is, in turn, secured to at least one of the closing members 812, 814. Other suitable manners of connecting the magnetic member to the frame 800 also can be used. In one embodiment, the closing members 810, 812 can be formed of a magnetizable member (e.g., a ferrous metal such as iron or steel) such that the

closing members themselves become magnetized. In such an embodiment, a fully concealed magnet could be used. In the illustrated embodiment, the recess extends through a forward facing surface of the at least one of the closing members 812, 814 thereby forming the window 834 or the like. The window 834 can be used to allow the magnetic field to be exposed in a desired direction (e.g., forward in the illustrated arrangement).

[0101] While the illustrated arrangement shows a temple 836 and the associated recess within the closing members 812, 814, it is anticipated that the eyewear 800 can be used in configurations not featuring temples. In addition, the closing members can accommodate a bridge or the like.

[0102] With the embodiment illustrated in Figures 33-35, the upper closing member 812 can be easily removed such that the magnetic member 834 can be easily removed from the frame 800, if desired. Such a construction enables a consumer to have magnetic eyewear or to not have magnetic eyewear while the eyewear manufacturer simply changes one very small part. Furthermore, opticians can maintain a stock of both magnetic and nonmagnetic closing members to simply and readily accommodate the desires of its customers.

[0103] With reference now to Figures 36-39, a portion of another embodiment of eyewear 900 arranged and configured in accordance with certain features, aspects and advantages of the present invention is illustrated therein. The eyewear 900 features another closing arrangement 902. The closing arrangement 902, is very similar to the closing arrangement 802 of the eyewear 800 discussed directly above. Rather to fully describing each component of the eyewear 900, a lower closing block 914 will be described to illustrate a difference between the closing member 814 of the eyewear 800 and the closing member 914 of the eyewear 900.

[0104] The closing member 914 features a recess 940 that cooperates with an enlarged end 942 of a cable 908. In the illustrated arrangement, the recess 940 is generally spherical and the enlarged end 942 is generally spherical, however, other geometries can be used. The recess 940 also communicates with a short passage 944 that allows the enlarged end 942 to be slipped into the recess 940 while the short passage 944 accommodates the end of the cable 908 that extends away from the enlarged end 942. This arrangement allows easy

replacement of the cable 908 when a wearer wishes to change lens shape or size or when other circumstances warrant the eyewear 900 being disassembled and reassembled.

[0105] With reference now to Figure 39, an embodiment is illustrated in which the magnetic members 950 are disposed in an orientation for coupling of a rimless auxiliary frame 952 to a rimless primary frame 954 along a substantially vertical axis. The magnetic members 950 preferably are disposed on or in arms 956, 958 that are secured to the respective lenses 960, 962 by a respective cable 964, 966 in any of the manners described above. While both sets of frames features the cable connection, one of the frames could have a more conventional frame not featuring a rimless look. Furthermore, in some embodiments, the orientation of the auxiliary frame 952 relative to the primary frame 954 can be interchanged such that the arms of the primary frame 954 extend over the arms of the auxiliary frame 952.

[0106] Although the present invention has been disclosed in the context of certain preferred embodiments and examples, it will be understood by those skilled in the art that the present invention extends beyond the specifically disclosed embodiments to other alternative embodiments and/or uses of the invention and obvious modifications and equivalents thereof. In addition, while a number of variations of the invention have been shown and described in detail, other modifications, which are within the scope of this invention, will be readily apparent to those of skill in the art based upon this disclosure. It is also contemplated that various combination or subcombinations of the specific features and aspects of the embodiments may be made and still fall within the scope of the invention. Accordingly, it should be understood that various features and aspects of the disclosed embodiments can be combined with or substituted for one another in order to form varying modes of the disclosed invention. Thus, it is intended that the scope of the present invention herein disclosed should not be limited by the particular disclosed embodiments described above, but should be determined only by a fair reading of the claims that follow.